

Aside from severe hemorrhage there is no other justification for operation except infection. Since hematomata are easily infected, faithful supervision of the case is absolutely necessary if conservatism is attempted.

I have recently seen five cases of acute traumatic rupture of the kidney, all of which recovered under expectant treatment and were promptly returned to full duty, with sterile urine. One case had hematuria for thirty-three days, and the bleeding was stopped by injecting by gravity with a twenty-four-inch column of 13½ per cent sodium iodide solution to make the accompanying pyelogram. At that time the function of the damaged side was 50 per cent normal (total phthalein now normal). A sixth case was first seen six months after injury, and the pyelogram showed the scar of a complete perpendicular tear that had destroyed the middle calyx. This kidney was saved, although all rules of procedure were violated; the patient fell three feet and had hematuria; for twenty-two days he was treated for pneumonia because of the leucocytosis and fever, then was operated upon by a general surgeon because of a tumor mass in the left lumbar region the size of a "small watermelon," and a "gallon of urine" was evacuated; cystoscopy seven days later showed that all of the urine from the affected kidney was being discharged through the drainage tube, and the opposite kidney was infected. This man is back at work with two kidneys, both uninfected, and the damaged one has a function of 50 per cent normal.

Doctors Day and Martin have clearly shown that the mortality of traumatic rupture of the kidney has been reduced to a vanishing point by: (1) Operative intervention for the arrest of hemorrhage which otherwise rapidly proves fatal; (2) an appreciation of those signs which heralded the failure of expectant treatment; and (3) the prevention of infection.

## USE OF SODIUM THIOSULPHATE IN METALLIC POISONINGS \*

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*Sodium thiosulphate is the logical drug of choice in the treatment of acute and chronic poisonings by a group of the heavy metals.*

*It materially shortens the length of disability caused by these poisons.*

*Moist applications of a 1 to 2 per cent solution of sodium thiosulphate are beneficial in the treatment of burns and dermatitis caused by arsenic and mercury.*

*DISCUSSION by Gayle Mosely, Los Angeles; C. O. Sappington, Oakland.*

FOR many years chemists have used non-metallic sulphur as a precipitant for a group of heavy metals, among which are found arsenic, mercury, lead, copper, bismuth, and zinc. Toxicologists, however, apparently overlooked this precipitant action of non-metallic sulphur, and it is of only recent date that some of the non-metallic sulphur groups have been successfully used in medicine as a precipitant for these metals when taken into the body, either as a means of attempting death as a therapeutic agent, or as the result of occupation.

The chief non-metallic sulphur derivatives are calcium sulphide, calcium sulphite, and sodium thiosulphate. Sodium thiosulphate is a white crystalline substance slightly alkaline in reaction, and readily soluble in water. It is prepared by heating sulphur with sodium carbonate, dissolving this resultant in water, filtering, boiling the filtrate with sulphur, refiltering and concentrating. It converts all of the

soluble toxic metals mentioned into insoluble non-toxic compounds.

The work on which this report is based, covering the treatment with sodium thiosulphate of acute and chronic poisonings by metals of this group, has been carried out at the Salt Lake County Hospital, St. Mark's Hospital, and the plant of the United States Smelting and Refining Company at Midvale, Utah.

The first cases we will report are those of two typical ones of arsphenamin dermatitis.

**Case No. 1**—Mr. J. H., American, age 53. Gave a four plus Wassermann test. He had a chronic syphilitic osteomyelitis, which had been operated upon several times, with a resultant suppurating fistulae. He was given .400 of salvarsan. In five days this dose was repeated. The day following this dose he developed a macular rash upon the face and hands. The next day the entire body was red. His hands, legs, and face were swollen. There was a serous exudate involving principally his face and arms. He was immediately given sodium thiosulphate .500 intravenously in 20 cc. of water. The following day he was given .900. With the second dose his symptoms began to disappear. By the time he had received five doses his symptoms were gone, and by the twelfth day he had completely recovered.

**Case No. 2**—Mr. W. W., age 52, was suffering with a syphilitic gummas of the arm and leg. Anti-syphilitic treatment was started. He received, covering a period of two months, nine doses of salvarsan. The first course consisted of six doses, and the second three. Three days following the last injection the skin of the face and neck became red, dry, and itching. Two days later the eruption spread to cover his body. The skin was red, swollen, and weeping. The first day he was given .3 gm. of sodium thiosulphate intravenously, the second day .3 gm., the third day .45 gm. By this time the edema had practically disappeared and the redness was diminishing. He was given subsequent doses of .6, .9, 1.2, and 1.8 gms. By the fifteenth day his symptoms had all disappeared and his skin was normal.

These cases illustrate the effectiveness of this preparation in shortening an attack of arsphenamin dermatitis from two months or longer to as many weeks.

The success which we have had in the treatment of local dermatitis and burns due to the external application of arsenic have been equally as gratifying, as has that of treating arsphenamin dermatitis. These cases are too numerous to tabulate, and one case will probably suffice for the entire group, as all have reacted practically the same.

**Case No. 3**—Mr. C. P. O., American, age 57, employed in the bag-house at the smelting plant. He complained of stiffness of arms, legs, fingers, and toes. The exposed surfaces of his body were very red. There were several ulcers on his hands. Lotions had been applied to the skin, and ointments and boric acid dressings to the ulcers. Very little progress was noted. The skin continued to itch and burn, and the ulcers refused to heal. He was given six doses of sodium thiosulphate intravenously, ranging from .3 gm. on the first day to 1.8 gms. on the sixth day. By the sixth day the redness of the skin had diminished, and by the eighth day the itching had all disappeared. The stiffness and soreness of the muscles had completely gone. The ulcers on the hand had been treated additionally by moist applications of sodium thiosulphate and a solution of the drug had been given by mouth. The ulcers rapidly cleared and by the end of the second week had completely healed.

Previous to the use by us of sodium thiosulphate, the men who worked in the bag-houses and arsenic plants were required to take a shower and a complete change of clothing when coming off shift. Despite these precautions, there were numerous arsenic

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burns and arsenic dermatitis. Noting the very favorable effect of solutions of sodium thiosulphate externally, we recommended that the employes in the bag-house and arsenic plants be required to take a daily shower in a solution of sodium thiosulphate. The men are now required, when coming off shift, to take a shower bath from a tank containing a 1 per cent solution of sodium thiosulphate. After this they then take their cleansing bath and change of clothing. They are also given an ointment of 1 gm. sodium thiosulphate to the ounce. This is put in the nostrils, around the eyes, and in the ears. Since the introduction of these precautions, arsenic burns, dermatitis and irritations of the nose and eyes, and abdominal colics, have become the exception rather than the rule; the men are happier, do better work, and little complaint is heard concerning their occupation.

Our experience with acute and chronic lead poisoning has been more phenomenal than has been that of arsenic; in fact, it has now become the routine that all men applying for treatment and complaining chiefly of vague abdominal pains, even before the blood shows any change, are immediately given intravenous doses of sodium thiosulphate, with the result that, after two to three doses, they are completely free from pain. As with arsenic, so with lead, these cases have been too numerous to give a complete tabulation here, but two cases, one from the smelter and one from a city plumber, will probably suffice as typical group pictures.

**Case No. 4**—Mr. J. S., Serbian, age 40, had been away from duty for one week on account of abdominal pain. His family physician had used all of the better known remedies for lead poisoning, with practically no effect. At the beginning of the second week he applied to us for treatment. The first day he was given 1.2, 1.6 and 1.8 gms. of sodium thiosulphate intravenously. The second day the dosage was repeated. By the third day his pain had all disappeared. The third day he was given two doses of 1.6 and 1.8 gms. each. The fifth day he returned to work a well man, and has not applied for any treatment since that time.

**Case No. 5**—R. J., negro, plumber, age 32. For two months he had been practically incapacitated on account of abdominal pain. One month of this time had been spent in hospitals. On admission to the county hospital, he was in such pain that his thighs were almost completely flexed on his abdomen. His bowels had not moved for four days. He was given  $\frac{1}{2}$  grain morphine, 2 ounces of magnesium sulphate, and three doses of 1.6 gms. each of sodium thiosulphate the first twenty-four hours. The next day his pain was greatly relieved. The sodium thiosulphate was again repeated. The second day his pain had practically disappeared. The third, fourth, and fifth days he was given two doses each day of 1.2 gms. By the sixth day his pain had all gone, and he left the hospital to return to his work.

Our experience with mercurial poisonings has not been as extensive as it has been with arsenic and lead, but we believe that the results have been sufficient to warrant the recommendation that this chemical be kept on hand in all emergency hospitals where a dose could be immediately given in any case of mercurial poisoning.

**Case No. 6**—Mrs. J., American, age 23, took by mouth thirty 1-grain tablets of bichloride of mercury. She was found about four hours later. She stated that she had vomited about one hour after taking the tablets. She was taken to the Emergency Hospital, where she was given a stomach lavage, and later was brought to the County Hospital. At this time she was passing blood from the

bowels and vomiting blood and bile. The urine was scanty and smoky. The abdomen was distended and tender, especially over the ileocecal region. By March 1 the tongue was so swollen that it practically filled the mouth. The teeth were loose and there was marked necrosis of the gums. March 7 she aborted a six weeks' partially macerated foetus. March 8, patient in partial coma. Refused all food or liquid by mouth. March 10, .3 gm. sodium thiosulphate was given intravenously. March 11, 45 gms. March 12, 6 gms. March 13, 9 gms. March 15, 1 gm. March 17, 1.2 gms. March 19, 1.8 gms. By March 11, the day following the first dose, the patient was some brighter, the tongue not as badly swollen, and she asked for food. March 15, appetite good. Tongue decreasing in size. Teeth very loose, but necrosis of gums is improving. March 20, tongue practically normal. Gums greatly improved. Loose teeth and some necrotic bone removed. April 1, sent to the county jail. The mouth is a little tender, but otherwise she is practically normal.

**Case No. 7**—J. B., American, age 24, took two tablets of bichloride of mercury,  $7\frac{1}{2}$  grain, in mistake for other medicine. He discovered his mistake in about one hour. A stomach lavage was immediately given and an intravenous dose of 1.6 gms. of sodium thiosulphate. This dose was repeated in four hours. The following day the urine gave a test for mercury. He was given eight doses averaging about 1.5 gms. of sodium thiosulphate. He made an uneventful recovery with no symptoms of mercurial poisoning, except a looseness of the bowels and some tenesmus.

**Case No. 8**—R. H., age 28, took 100 1-grain tablets of bichloride of mercury. He was found about one and one-half hours later. At this time he was vomiting blood, and passing blood from the bowels. He was sent to a hospital, where he was given sodium thiosulphate both by mouth and intravenously. The hemorrhage from the bowels, bladder and stomach continued, and he died twelve hours later.

**Case No. 9**—D. H., age 45, had scabies. He put one heaping tablespoonful of powdered bichloride of mercury in a pint of water and rubbed it on his body. When seen by us four days later he had a complete suppression of urine which had been present for two days; practically the entire surface of his body was burned. He was given sodium thiosulphate, 1 gm. intravenously every eight hours, and was given 15 gms. the first day by mouth and afterward 5 gms. daily. Moist applications of a 2 per cent solution were applied to the burned surfaces. The first two days after treatment was started he continued to pass blood from the bowels. This disappeared, but the bowels remained very loose. The burned areas greatly improved, but he died on the ninth day, having then had a complete suppression of urine for seven days.

Some of the earliest work on the use of sodium thiosulphate in metallic poisonings done by McBride and Dennie, they advocated the following dosage: .3 gm. first day; .45 gm. second day; .6 gm. third day; .9 gm. fourth day; 1.2 gm. sixth day, and 1.8 gm. the eighth day. We have found that these dosages can be greatly increased with a resultant more rapid modification of the symptoms and with no unfavorable manifestations or discomfort to the patient. In our earlier work we followed the dosage of McBride and Dennie, but in our later work we have been using, as an original dose, 1 to 1.2 gms. and as high as 1.8 gms., and have repeated this dose from two to three times daily. In all cases treated we gave sodium thiosulphate by mouth daily. The first day the patients were given 15 gms. in 500 cc. of water, and daily thereafter 5 gms. in the same amount of water, distributed as small drinks throughout the day.

#### CONCLUSIONS

1. Sodium thiosulphate is the logical drug of choice in the treatment of acute and chronic poisonings by group of heavy metals.

2. It materially shortens the length of disability caused by these poisons.

3. Its more general use by corporations where the health of employes is influenced by these metals should be urged.

4. Moist applications of a 1 to 2 per cent solution of sodium thiosulphate are beneficial in the treatment of burns and dermatitis caused by arsenic and mercury.

5. In acute cases of poisonings by these metals, the original dose of sodium thiosulphate should be 1 gm. intravenously given once, twice or three times daily, depending upon the symptoms.

6. In our series of over one hundred cases we have had no reactions in either large or small doses, and the only effect we have seen between the large and small doses is a more rapid amelioration of symptoms.

#### DISCUSSION

GAYLE G. MOSELEY, M. D. (National City Bank Building, Los Angeles)—The paper of Drs. Roberts and Hosmer serves to emphasize the importance of scientific medicine to industry. I hope in the near future some ethical way may be found to bring to the attention of industry the developments in medicine and surgery that have a direct relation to business. This could be done through the publications of the various trade associations. Any measure that serves to lessen the period of disability of a sick or injured employe not only lessens the suffering of the employe, but means an actual saving of money for both employer and employe. If the employe receives compensation during his period of disability it is much less than would be his actual earnings.

I am particularly interested in the results obtained from the sodium thiosulphate in lead poisoning. Notwithstanding the great advance made in the prevention of this trouble, it is still seen quite frequently in industrial cases. Many of the smaller concerns, such as small plumbing and painting contractors, take no special precautions to prevent this disease. Sometimes special conditions arise in large plants that cause much sickness and suffering to the employes, as well as expense to the employer, before the necessary steps can be taken to prevent the trouble. Within the past year one of the largest shipbuilding concerns in the bay district had a contract to tear down a number of Government vessels. These boats, of course, had all been painted many times with white lead, and the result was a very large number of cases of lead poisoning, some of which were quite serious. In fact, the condition was so bad that the insurance carrier had to cancel the risk, at considerable loss. This example is cited simply to show that lead poisoning is always with us.

It seems to me that early recognition of these cases is of great importance, in order that treatment may be administered before changes take place in the blood. Doctors engaged in industrial medical practice should always be on the lookout for cases of lead poisoning, as they often occur unexpectedly and from plants where ordinarily one would not expect such cases to occur. If the readers of the Journal will bear in mind that lead poisoning is much more common than generally supposed, and make early diagnosis and apply the treatment recommended in this paper, it will be another long step forward in showing the business man that he needs the doctor in this business.

C. O. SAPPINGTON, M. D. (Hutchinson Building, Oakland)—Drs. Roberts and Hosmer have brought to our attention a very interesting chemotherapeutic reaction. The administration of calcium sulphide to workers exposed to lead is not new, and is alluded to in the literature by Sir Thomas Oliver, Marvin Shie, Alice Hamilton, and other experts on lead poisoning; but the intravenous injection of sodium thiosulphate as a rational therapeutic procedure in cases of metallic poisoning, is new and certainly seems full of promise, in the light of the experience of Roberts and Hosmer.

It appears that sodium thiosulphate would be the logical drug of choice in acute and chronic cases of poisoning from the heavy metals, with the exception of chronic plumbism. We know from the excellent researches of the Harvard Lead Unit, which recently completed three years of experimental and clinical work on various phases of lead poisoning that, in the chronic type of lead intoxication, the lead is stored in the compact portion of the long bones. Various substances were tried, in order to ascertain just what was most efficacious in releasing the stored lead. Among other factors, it was discovered that a distinct change in the acid-base equilibrium toward the acid side would release the combined lead and set it free in the circulation so that it might be eliminated (of course, this is a dangerous process and may give rise to acute symptoms). Phosphoric acid in dilute solution was found to be the substance causing the setting free and excretion of lead in greatest amounts, as checked by estimations of lead in the urine and stools. I must confess my ignorance as to the relative merits of the thiosulphate of sodium as a compound which will cause lead excretion; but if it was possible that the insoluble, non-toxic compound formed by the thiosulphate could be eliminated by way of the urinary or gastro-intestinal tracts, after lead had been set free in the circulation by the use of dilute phosphoric acid, it would appear that the procedure of Drs. Roberts and Hosmer would be a very valuable adjunct in the deleating process in cases of long-standing chronic plumbism.

Dr. Moseley has spoken about the importance of lead poisoning as a problem of industrial medicine. I should like to add just a few words to what he has said. Many cases of lead poisoning are not recognized in industry because the industrial physician has not taken the trouble to familiarize himself with the progress made in the recognition of early signs and symptoms of this affection. Lead intoxication contributes over half of all the cases of poisoning due to contact with metallic substances used in various industrial processes. Where a lead hazard is definitely known to exist, certainly all the intelligence possible should be brought to bear on the aspect of prevention.

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**Transfusion of Lymphocytes**—A patient in an advanced stage of generalized lymphosarcoma, whose white blood cells were 6400 per cubic millimeter and lymphocytes 15.5 per cent, was transfused by G. R. Minot and Raphael Isaacs, Boston (Journal A. M. A., June 6, 1925), with 450 c.c. of blood from a patient with chronic lymphatic leukemia, whose white blood corpuscles numbered 89,000 per cubic millimeter and lymphocytes 95.6 per cent. This transfusion produced no greater benefit than one with normal blood. The transfusion caused the percentage of lymphocytes in the recipient's peripheral blood to be increased immediately about threefold, and their absolute number nearly four times. The number and percentage of lymphocytes dropped almost to their pretransfusion level within thirty-five minutes of the completion of the transfusion, and reached this level within at least two and a quarter hours without a subsequent significant change. There was no evidence that the transfused lymphocytes were destroyed in the peripheral circulation.

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**Tryparsamide in Treatment of Neurosyphilis**—Continued observation, with a larger number of cases and over a longer period of observation, has convinced Udo J. Wile and Lester M. Wieder, Ann Arbor, Mich. (Journal A. M. A., June 6, 1925), of the value of tryparsamide in producing clinical betterment in almost 30 per cent of a carefully selected group of cases. In the main, clinical improvement was not paralleled by striking changes in the spinal fluid, many of the most strikingly improved patients retaining, after protracted treatment, the changes in the fluid that were found at the original examination. In a small group of cases in which spinal fluid change was noted, clinical betterment was found to be associated with such improvement. When improvement occurred clinically, this was indicated in a large majority of the cases during the first and second courses of treatment.